population during the last few years. It is anticipated that at the end of the next half century there will be 200 million people to feed. It has for some time past been recognised that the arid regions of the West, at the foot of the Rocky Mountains, consisting of enormous areas of barren sands broken only by patches of yuccas and sage bushes, becomes, if irrigated, capable of growing crops of all kinds and in the greatest luxuriance. Already where irrigation has been applied, the traveller almost suddenly passes from a desolate and an apparently worthless region to a land of plenty, and is confronted by orchards and gardens which resemble the century old creations of France and Italy, with homes rivalling in taste and convenience those of the eastern States. The climate, though arid, is remarkably healthy, the heat of the southern summers and the cold of the northern winters being mitigated by the dryness of the atmosphere. The mountains and valleys of this district are recognised as natural sanitaria, to which thousands of persons resort in order to live. The arid land, when irrigated, is capable of producing crops worth 20*l.* an acre. Oranges and grapes grow and ripen abundantly, and in Southern California an orange grove of twenty acres constitutes an estate.

The value of the land for raising crops when irrigated became first recognised by the flourishing condition of the colony established by Horace Greely in Colorado, and after his success numerous irrigation schemes were set on foot, both by single settlers and companies. The first step in the change from sage bush desert to fields of grain is the construction of a ditch by the small holder, or of a canal which shall be large enough to water several farms. These canals, in some cases, are large enough to supply from five hundred to a thousand eighty acre farms. The water is supplied to the farmers in fixed quantities, measured either by the miner's inch or the cubic foot, being the volume of water that will flow through an inch or foot square orifice under a designated pressure; or else by the acre foot, being the quantity required to cover an acre to a depth of one foot. The price paid for the water varies according to the locality and the cost of the works.

When the rivers and streams carried a surplus, water was diverted with lavish prodigality, and irrigators gave scant heed to their respective rights because, so long as each had all he needed, he was satisfied. When, however, irrigated agriculture became an assured success, and the area of the irrigated farms increased, innumerable quarrels and law suits as to water rights ensued, and as, according to the author's estimate, there is only a sufficient supply of water to irrigate one-tenth of the arid West, the right to obtain this will be guarded with greater jealousy as time goes on. The laws in the different States as to these rights vary considerably, and are set out with much detail by the author. This, together with the practical information given as to irrigation, will render this book of very great service to those engaged either as settlers on the irrigated lands or to hydraulic engineers engaged in laying out irrigation works.

OUR BOOK SHELF.

Algebra. Part i. By Kaliprasanna Chottoraj. Pp. vi+482. (Calcutta: The City Book Society, 1903.)

THIS book is "an elementary treatise on algebra intended for use in Indian high schools." "Each rule and each process are followed by a well-graduated and sufficiently large collection of examples." These quotations from the preface serve to characterise the book. It is intended for beginners, and includes the theory of indices, and proportion, but not quadratic equations. The book is too full of rules and processes, and the student is in danger of losing his grasp of the fundamental ideas through the bewildering number of special methods, and may be led to think that he must remember the many rules and artifices which can only be acquired by practice and experience. Thus, for instance, under the heading of the resolution of x^2+ax+b into factors, we find a first method, a second method, followed by two important hints and forty-five examples; then ax^2+bx+c is treated on the same lines and at the same length.

The explanations of fundamental principles are sound and clear, and seem designed to meet every conceivable difficulty, but there is a tendency to lay stress on unessential features and mere details of presentation. As an instance of exactness, it is shown how the lowest common multiple need not be the least in an arithmetical sense. We are glad to see a whole page devoted to the distinction between an equation and an identity.

An attempt is made to define the order of the operations in an expression such as $a \div b \times c$. This can only lead to confusion and mistake. The use of brackets should be taught from the beginning.

The book is poorly printed, but of a convenient size, and will doubtless prove useful to those for whom it is intended. R. W. H. T. H.

Practical Chemistry and Physics. By J. Young, A.R.C.S., F.C.S. Pp. 108. (Woolwich: Cattermole, 1903.)

THE space allotted to "physics" is so very limited (9 pages out of 108) that the book may be considered as one on practical chemistry.

As a laboratory guide to chemical analysis there is little to distinguish it from many others dealing with the same subject. The individual reactions for the metals and acids are followed by analytical tables and a few exercises in gravimetric and volumetric analysis. A page is usefully devoted to the detection of impurities in common reagents.

The utility of a book of this kind depends in the first place on the student's previous training in practical chemistry, for it would be out of the question to put a beginner through a course which deals almost exclusively with inorganic analysis; in the second place, it depends on the amount of supervision exercised by the demonstrator, for there are neither drawings of apparatus nor details of manipulation. Granted the necessary training and supervision, one is nevertheless led to suspect from observations dropped here and there that it is not a quickening spirit of philosophic inquiry which pervades the book, but the heavy atmosphere of the examination room. "The test is too delicate for ordinary use." "Be careful always to add excess of the group reagent. Any less is quite useless; the ppt. not only fails to come, but afterwards appears in the wrong place, besides giving rise to other complications." "When the number of bases known to be present has been found, the analysis can be stopped."

A reminiscence of the old stock question of the

Science and Art elementary paper is contained on p. 73 under the heading of "How to construct chemical equations." The expression "two thicknesses of blue glass" might be more explicit, and the same may be said of the term "injurious" applied to an excess of barium chloride. Many of the pages are unnumbered, and there are numerous misprints. J. B. C.

Elements of Physics. By Ernest J. Andrews and H. N. Howland; to which is added a Manual of Experiments. Pp. xi+386+53. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1903.) Price 6*s*.

THE aim of the writers has been to present an account of physics suitable for secondary schools. With this aim in view, they have avoided everything of a purely academic character—with the exception of "little bits of history" which they make a point of inserting. The book is of a very elementary character, and is almost completely free from any mathematics except the simplest arithmetic. More attention is paid to a delivery of the facts with which a pupil is expected to be acquainted than with formal proofs of the relations between them. The authors' methods may be indicated by the constant recurrence of the two phrases "it is evident" and "just as." The latter phrase shows the reliance placed on the method of analogy; the former phrase sometimes means *it is easily proved by simple experiments*—and suitable experiments are then described; sometimes it appears to be used merely to help over a difficult point. Great emphasis is laid on a pupil learning a thing by observation, and this is as it should be. An adequate course of introductory experiments is given in the "Manual."

In general, the explanations given are clear and sufficiently accurate. It is true that the man who is clothed with the love of accuracy as with a garment will not take much pleasure therein. But there is a rapidly growing class of students—the product of county scholarships, &c.—who, owing to imperfect mental training, require knowledge to be served up in a simple if even somewhat loose way; and these requirements deserve to be satisfied.

In a few places there are unfortunate slips. The reference to "permeability" on p. 183 is quite misleading—it is confused with "retentivity." Again, in connection with the liquefaction of gases, it is explained how a little liquid air may liquefy a lot; this savours of the monthly magazines. These misconceptions should be cleared up in a future edition.

First Steps in Photo-Micrography. By F. Martin Duncan. Pp. 104. (London: Hazell, Watson and Viney, Ltd., 1902.) Price 1*s*. net.

THIS little work is intended, as its title implies, to be a guide for those who are beginners in a fascinating branch of photography. It is avowedly written for photographers, and not for microscopists, so that much that is passed over may be excused. The apparatus stated to be necessary is such that good work may be accomplished even with moderately high powers.

The tendency has been of late to advise beginners to attempt some photomicrographic work with the most meagre appliances, thereby increasing their difficulties at the beginning.

It is satisfactory to note that in this little book simple yet efficient appliances are advised. The portion devoted to the illumination of objects, perhaps the most important part of the whole subject, is treated all too briefly, but in other respects the book may be recommended to those who are commencing photomicrography, as a useful guide which will materially assist them in their earliest efforts.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Radio-active Gas from Well Water.

I HAVE recently found that water from deep wells in Cambridge contains a radio-active gas, and I am anxious to see whether water from other sources possesses the same property. I should be greatly obliged if any of your readers who have access to deep level water would fill a clean two-gallon can with it and forward it to the Cavendish Laboratory. I should, of course, pay the carriage and return the can. I may say that I have already had samples of water from Birmingham and Ipswich, each of which contained the gas. J. J. THOMSON.

Cavendish Laboratory, Cambridge, April 25.

Can Dogs Reason?

DR. HILL has recently asked the question, "Can dogs reason?" The following analogy has always appeared to me to be a sufficient reply. In ordinary circumstances, few human beings make use of their sense of smell; to excite it, the odour must be fairly strong, and also unusual. It may be regarded as probable that few dogs make habitual use of any power of inference, but have only vague sensory impressions, to which an almost automatic response is given. Yet under sufficient stimulus, they may perform acts involving an exertion of a considerable amount of "thought." Whereas, then, dogs rarely "think," but frequently make use of their delicate sense of smell, human beings seldom make use of that sense, but constantly exercise their reasoning faculties.

Again, is not the opening of a box somewhat akin to the exercise of an inventive faculty? Teach a man how to operate a complicated machine of which he does not understand the mechanism, and it may be doubted whether he will connect the process of setting it in motion with some desire to gain an advantage which is not obviously attained by doing so.

I am tempted to describe an occurrence which reveals in a dog which I have at present the possession of two rather rare qualities of mind for a dog. One is the accumulation of brightly coloured objects. This dog sleeps on a mat in a basket. On taking out the mat to clean it, a strange collection of articles is generally neatly arranged below it; I remember, for instance, large pieces of red sealing-wax attached to strings, a comb, a piece of whalebone, a Brussels sprout, some lumps of coal showing pyrites, a polished dry rib bone, some kindling sticks with resin, &c. These objects had not been gnawed, but merely placed under the mat as valued possessions.

Again, this dog has a keen sense of a joke. Some days ago, a small dog with a loose chain was wandering in the garden. Its owner came out and called it. My dog caught the chain, dragged the little dog away, and waited events. As soon as the owner approached, the small dog was dragged out of reach, and it was not until after a long chase that the little dog was captured. These small incidents show, I think, that it is as impossible to classify all dogs together as it is to classify human beings; their minds naturally run in very different directions, and, just as there are inventive or artistic men, so dogs may show leanings towards special developments of their minds. WILLIAM RAMSAY.

Bullfinch and Canary.

THAT a bullfinch can be trained to pipe a whole tune, or more, to perfection, that is to say, do it, so far as intonation and rhythm are concerned, as well as any skilled musician, everybody knows. It is also a fact, though perhaps less common, that a canary, placed in an adjoining room and hearing the tune of such a piping bullfinch over and over again, may, quite by himself, *i.e.* without being trained for it, acquire the same accomplishment to the minutest detail.

An experience, however, which I have had during *a*